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COMMAND AND CONTROL IN A NETWORK CENTRIC ENVIRONMENT.

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Submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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15. Abstract:

Networking and NCW will change the way we operate in the Armed Forces. Advances in technology will result in the realization of some of the benefits identified, as well as the elimination of some of the risks. The decision on how to employ NCW will depend on how its capabilities evolve. The future commander will be wise not to limit himself to one method of command and control based totally on previous experience but instead evaluate each mission anew against the capabilities he has from network centric warfare and the risks and rewards of employing different methods of command and control.

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UNDERWAY

A cool wind blew off the coast of southern Spain. Two great fleets were only hours away from an immense naval battle. As sailors prepared their watchstations, the Admiral slowly paced the deck in silent contemplation. "Lieutenant Pascal, amuse the Fleet with a signal."[1] The signal was composed and after a small revision quickly run up the halyard. "England Expects that Every Man will do his Duty."[2] In the ensuing battle only one other signal was sent - "Close action."[3] These two signals comprised the total of force communications for one of the most decisive and important battles in naval history.

Communication technology has changed greatly since Admiral Horatio Nelson's great victory in the Battle of Trafalgar. Today the Internet and networking have resulted in profound changes in many facets of our lives. As advanced computer technology and networking spreads throughout the military, those of us in uniform have also witnessed the tremendous effects these forces can have. In 1995 Vice Chairman of the Joint Chiefs of Staff Admiral William Owens foretold of an "emerging System of Systems."[4] As further research on this idea was pursued the concept of Network Centric Warfare was developed.

Network Centric Warfare (NCW) is about how military force

can be more effective through the networking of people and systems. Three grids - the Sensor grid, the Engagement grid and the Information grid, enable NCW. The sensor grid links all sensors in a battlespace. This grid enables sensor data to be fused to provide a more accurate battlespace picture. No longer will platform commanders be limited to only the sensor data provided by their platform sensors. The engagement grid, like the sensor grid, links all weapon systems via the network. This grid will allow operators access to any weapon system in the battlespace. The information grid is comprised of the infrastructure to "receive, process, transport, store, and protect information for Joint and combined forces."[5] Through networking of the sensor and information grids a more accurate and complete battlespace picture will be developed which will in turn result in improved battlespace knowledge.

Two opposing views have emerged in regards to what method of command and control will be used to employ Network Centric Warfare. One side argues that the value of NCW lies in the great empowerment of the individual warfighter. Decentralized command and control (C2), which they contend is the best method to execute NCW, will give friendly forces an overwhelming advantage by allowing each individual warfighter to act on the information superiority provided by the network.

Opposing this view are those who believe that greatly expanded communications capabilities and improved battlespace knowledge will lead to more centralized command and control. "The likelihood that greater experience and knowledge will reside at higher command echelons would seem to argue for centralizing decision making and control to the fullest extent allowed by communications capacity."[6]

Both views of NCW seem to characterize command and control (C2) in a network centric system as an either/or proposition - centralized or decentralized. When in fact both methods of C2 will likely need to be accommodated. Joint Vision 2010 addresses this potential:

> *New technologies will allow increased capability at lower echelons to control more lethal forces over larger areas, thus leveraging the skills and initiative of individuals and small units…. Concurrently, commanders at higher echelons will use these technologies to reduce the friction of war and to apply precise centralized control when and where appropriate.*[7]

Advances in technology will determine the possible C2 options available to commanders utilizing a network centric system. However, the commander must still decide what method of C2 will be implemented. Commanders today face the same challenge that Nelson had in the early 1800s. What method of C2 will best employ their forces in view of existing communication technology and the mission they will undertake?

This paper will argue that future commanders should not limit themselves to one method of command and control in a network centric environment but should instead recognize the benefits and risks of each method, so they can make informed decisions on what C2 method, or combination of methods, they will employ. It is crucial that this topic is studied and debated now so that effective operational doctrine may be developed in parallel with the technological developments that bring NCW closer to its final potential.

COMMAND AND CONTROL (C2)

Command and control is the method by which a commander synchronizes his forces to obtain a military objective.[8] While all the forces under the commander may be involved in the planning of the operation, it is in fact the commander who gives the final approval of the plan. Thus planning an operation is normally a centralized process. However, execution of the plan can be either decentralized or centralized. Under decentralized execution, subordinate forces, armed with the commander's intent, execute the operation to the best of their ability. Under centralized execution the commander and his staff issue orders to control the execution of the operation. When speaking of decentralized or centralized C2, "decentralized" and "centralized" refers to the method of execution. The ability

to employ either decentralized or centralized C2 can be better understood by taking a historical perspective of C2 and the operational factors of Time, Space and Force.

C2 AND THE OPERATIONAL FACTORS

Throughout history commanders have normally selected their method of C2 (centralized or decentralized) based on their ability to manage the operational factors. Commanders in control of a small number of *forces*, operating within a geographically limited *space*, with a moderate operational tempo (*time*), could use simple communication methods and basic doctrine to maintain centralized C2. If the existing technology was unable to manage the operational factors of time, space and force, then decentralized C2 was used to bridge the gap. The following examples illustrate these observations.

In the early days of sailing ships, the only method to communicate beyond visual range was via letter carried by another vessel. This manner of communications was ineffective in managing the operational factors of space (the great distance separating the sailing ships from their homelands) and time (the months it would take for communication via letter to occur). Because of this, naval commanders, such as Commodore Perry, were afforded decentralized strategic command and control. Commodore Perry was operating only with his

understanding of the President's intent when in 1854 he sailed into Edo Bay, Japan and commenced his exploits to open Japan to the United States.

As improvements in communication technology were made centralized C2 became more of a reality. During the Civil War the telegraph permitted President Lincoln to maintain centralized strategic command and control over General Grant. The telegraph was suitable for strategic purposes because longer periods of time could be allocated for strategic decisions without adverse impact. However, at the operational and tactical level of war the telegraph was insufficient to bridge the factors of time or force. The telegraph could not effectively communicate to the large numbers of forces employed in the timeliness required or provide access to units on the move or ships at sea. Because of this limitation it was necessary to employ operational and tactical decentralized C2.

A more modern example can be seen in the development of the Cooperative Engagement Capability (CEC). Cooperative Engagement Capability networks the sensors, fire control and weapons systems of participating units. Through the use of the CEC network an air defense commander is able to perform effective force employment - identifying when to engage an incoming target and the weapon to engage it with. The air

defense commander has centralized operational control over all connected weapons systems.[9] CEC demonstrates that even at the tactical level, where time is often extremely limited, centralized C2 can be successful with today's networking and communications technology.

From the above examples it can be seen that the degree to which a commander can employ centralized C2 is decided by the relationship between the operational factors and the existing communication/information technology. In general, improvements in communication technology have opened the door for centralized C2. However, these same technological advances have also led to improvements in the execution of decentralized C2.

For the commander to decide which method of C2 is most optimum he must first evaluate each method against the framework of a network centric environment. We will examine command and control in four areas that represent their primary strengths and weaknesses: information, operational tempo, risk and vulnerability to debilitating attack.

INFORMATION

Traditionally centralized C2 has had an information advantage over decentralized C2. The central command was a collecting house for many sources of information giving it the most accurate battlespace picture. Decentralized command

information consisted of its own platform sensor information and any other information received from a few external sources. Under these circumstances, information superiority allowed central commands to make the most optimum operational decisions. NCW effectively removes this information advantage by providing all warfighters with access to the same information.

OPERATIONAL TEMPO

The primary benefit of decentralized C2 has always been the speed of action gained by allowing subordinate commands to act on their own initiative. NCW's engagement grid would give a central command access to the same weapons systems as all subordinate commands. By allowing a central command to act immediately on their decisions the time previously required to generate and transmit messages directing operational or tactical actions would be eliminated.

Certain networking effects would likely have similar influences on both methods of C2. Reliance on network information could slow operational tempo due to "incoming traffic acting as a brake on decision-making."[10] Likewise "information overload"[11] may overwhelm processing capabilities. However attempts at synchronization, due to different methods employed, would likely produce different results.

The current NCW philosophy proposes that the combination of a rule set and shared awareness will allow decentralized units to self-synchronize, achieving "perhaps the ultimate in increased tempo and responsiveness."[12] This method places a great deal of faith in the adequacy of the shared awareness and the rule set. In contrast to this, weapons execute orders originating from a centralized system could ensure synchronization of effects while providing weapon-resource management.[13] While this may appear to give centralized C2 the edge in operational tempo this argument should not be considered conclusive. The overall effect of access to engagement grid will be to level the operational tempo playing field between centralized and decentralized C2.

RISK

Decentralized C2 entails the risk that a subordinate's actions could result in unwanted escalation or inappropriate use of force. NCW could cause competing effects in this area. Information superiority provided by the network might improve Combat Assessment allowing less force to be used and lessening the chance of unwanted escalation. Competing with this, faster operational tempo and access to any or all of the weapons system connected to the engagement grid could greatly increase the chances of unwanted escalation or inappropriate use of force. These effects would act similarly for

centralized C2. Still, the level of experience and judgment at a central command will normally exceed that of subordinate commands. In this circumstance the relative risk advantage held by centralized C2 would probably not change.

VULNERABILITY TO DEBILITATING ATTACK

Centralized C2 has always posed the risk of critical C2 nodes being subject to debilitating attack. If subordinates in such a system were not self-reliant loss of centralized C2 would almost ensure defeat. Since NCW is based on a "network of networks", there is no single network that can be attacked. Instead numerous networks are connected, providing redundancy for information flow. While in theory this is true, it has yet to be established that the network can eliminate every potential Achilles Heel (such as satellites, satellite ground nodes, computer virus or infiltration by hackers). NCW may reduce the vulnerability of centralized C2. Nevertheless decentralized C2 will still provide the greatest security.

The previous paragraphs were meant merely to view the possible effects NCW may cause upon each method of C2. Before proceeding to the final section, it is necessary to first reflect on what appears to be a cultural bias for centralization down the chain of command and also decentralization up the chain of command. More simply stated we want to control those below us, but do not want to be

controlled from above.

OUR CULTURAL BIAS

Throughout Naval History many disasters have befallen commanders who erroneously implemented centralized command and control when the situation was not appropriate and technology was insufficient. The British losses in the Battle of Jutland are a prime example of this. During the battle a numerically superior British Fleet was unable to achieve a decisive victory over the German High Seas Fleet. Vice Admiral John Jellicoe attempted to "over-centralize"[14] his forces - a doctrine that was incompatible with the existing communications and C2 technology of the time. The end result was 14 British ships were sunk and 6097 lives were lost.[15] Unfortunately, the commanders below Admiral Jellicoe conformed to his ineffective authoritarian mold.[16]

On a personal level the idea of centralized command and control strikes foul with most members of any armed service who have seen the disastrous results when local commanders are overruled or tactically hindered by superiors who are acting on incomplete information or inaccurate perceptions. "Don't tell me how to do the job, just tell me what you need accomplished," is a commonly used phrase. In response to proposals of centralized command and control, critics recall the name of Admiral Horatio Nelson and his great victory at

Trafalgar. Nelson's victory requires examination.

Nelson's victory at Trafalgar provides a staggering contrast to the Battle of Jutland. In the 111 years separating these two battles no other British fleet actions with capital ships had taken place. At the time of Trafalgar advanced doctrine for signal flags was still relatively new, though it could have allowed Nelson to employ centralized C2. Nelson properly evaluated the mission he had undertaken, the tactics he would use (cutting the enemy line with the British Fleet in two columns), and the number of forces he sought to engage (27 ships and an additional 8 frigates). In view of these operational factors, and his knowledge that his commanders properly understood his commander's intent, he properly chose decentralized C2.

Nelson's subordinates clear understanding of his commander's intent cannot be overemphasized. Nelson had sailed and worked with many of his commanders for over two years. He knew through experience they would perform as he expected under challenging circumstances. This understanding enabled him to choose an aggressive tactic with confidence that he would not need to employ additional signaling to aid his commanders. In today's world of hastily thrown together joint task forces, commanders would be wise to consider Nelson's example before implementing decentralized C2.

Centralized C2 might be the correct method to minimize risk until a commander is sure his subordinates understand his intent.

It should be evident that Nelson's victory at Trafalgar, and all other cases where decentralized C2 are successful, is not a repudiation of centralized C2, but is instead an example of the skillful execution of decentralized C2 through proper training, experience and doctrine. Likewise, failures of past commanders who implemented centralized C2 does not mean that centralized C2 will not work in the future, but that an operational commander must carefully weigh the risks and benefits of each method of C2 based on the situation and mission presented. That an operational commander and his staff can only be involved in the planning of an operation and are henceforth limited to the sidelines as observers is a poor use of resources and a failure to recognize the strengths of centralized command.

UNCHARTED WATERS

As we look toward the future we can envision a range of military operations with which we will be tasked - from noncombat Military Operations Other Than War (MOOTW) to unlimited war. The vision each US armed service promotes "points toward the capacity to use military force with greater precision, less risk, and more effectiveness."[17] The missions

we undertake will include joint and multinational participants. In all of these circumstances we must evaluate the capabilities NCW provides, against the mission to be accomplished and its participants, in order to select the most effective method of command and control.

In the case of a multi-national force many areas must be addressed. Do our partners have compatible technology with which to participate in NCW? Is the level of risk of the operation low enough to trust them with decentralized C2? Even if they have compatible technology dare we give them access to "our" engagement grid? Can we maintain centralized C2 of our forces while multinational forces use decentralized C2? All these questions will need to be addressed as NCW, and its operational doctrine, continues to evolve.

COUNTERFIRE

Proponents of decentralized C2 may argue that reality conspires against truly "centralized optimal decisions."[18] Rarely are optimal decisions ever made. With the information superiority provided by the network subordinate commands could make just as effective decisions. While this may in fact be true, certain high-risk objectives may warrant the most centralized optimal decision possible. Additionally, most often the level of experience at the centralized command will be greater helping to minimize risk.

Critics of centralized C2 will argue that future operational commanders will destroy battle rhythm and hinder tactical operations by directing tactical actions instead of concentrating on the operational plan. The improved battlespace picture provided by NCW may definitely increase the temptation to do just that. Operational commanders will have to understand the risks of their direct intervention, and as already stated, implement the best method of C2 based on the situation.

CONCLUSION

Networking and NCW will change the way we operate in the Armed Forces. Advances in technology will result in the realization of some of the benefits I identified, as well as the elimination of some of the risks. The decision on how to employ NCW will depend on how its capabilities evolve. The future commander will be wise not to limit himself to one method of command and control based totally on previous experience but instead evaluate each mission anew against the capabilities he has from network centric warfare and the risks and rewards of employing different methods of command and control. If this course of action is not pursued we run the risk of creating dramatically new and improved warfare capabilities without the knowledge of how to effectively employ them – as happened with both the machine gun and

radiotelegraph in the 19th century.

In the end we would do well to follow Nelson's example: have thoroughly trained forces, establish simple but effective doctrine, ensure subordinates understand the commander's intent, and then choose the method of command and control that will best execute the mission.

NOTES

[1] Nicholas Tracy, Nelson's Battles: The Art of Victory in the Age of Sail (Annapolis, Naval Institute Press, 1996), 185.

[2] Ibid.

[3] Ibid., 186.

[4] William A. Owens, "The Emerging System of Systems," U.S. Naval Institute Proceedings, (May 1995): 37.

[5] Fred P. Stein, "Observations on the Emergence of Network Centric Warfare" http://www.dodccrp.org/steinncw.htm/ [17 October 2000]: 3.

[6] James R. FitzSimonds, "The Cultural Challenge of Information Technology," Naval War College Review, Summer 1998, Vol. LI, No. 3, 16.

[7] Joint Chiefs of Staff "Joint Vision 2010. America's Military: Preparing for Tomorrow." Office of the Chairman of the Joint Chiefs of Staff, Pentagon, Washington, D.C.: 15.

[8] Milan Vego, On Operational Art (U.S. Naval War College 1999), 269.

[9] David Alberts, John Garstka and Frederick Stein, Network Centric Warfare: Developing and Leveraging Information Superiority. 2d ed., (CCRP Publications, 1999), 171.

[10] Andrew Gordon, The Rules of the Game: Jutland and British Naval Command (Annapolis: Naval Institute Press, 1996), 585.

[11] Thomas P. M. Barnett, "The Seven Deadly Sins of Network-Centric Warfare," U.S. Naval Institute Proceedings (January 1999): 8.

[12] Alberts, Gartska and Stein, 174.

[13] The CEC concept discussed previously demonstrates this type of centralized synchronization.

[14] Gordon, 578.

[15] Geoffrey Bennett, The Battle of Jutland, (Wordsworth Editions: United Kingdom, 1964), 155.

[16] Gordon, 565.

[17] Owens, 36.

[18] Alberts, Gartska and Stein, 107.

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